AMERICAN AASHTO TRAC PROGRAM

by

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ABSTRACT

The Transportation and Civil Engineering Program (TRAC) is a program of the American Association of State Highway and Transportation Officials (AASHTO). TRAC is licensed to the University of Stellenbosch, Department of Civil Engineering for use in the country of South Africa and is also licensed to the University of Dar es Salaam, Department of Civil Engineering for use in the country of Tanzania.

TRAC's purpose is to introduce careers in civil engineering and transportation to students in High Schools Grades 9 through 12. The program provides 55 hands on activities designed for use in math, science, social studies and technology education classes. Each of the 55 activities addresses one or more standards of learning using examples that demonstrate one or more civil engineering or transportation principal.

Currently TRAC is in 23 states in the United States of America and 5 more states are considering joining this year.

This report will give an overview of the TRAC program's history, current status and future plans. Equipment upgrades to the existing TRAC PAC will be demonstrated and TRAC PAC 2, the next generation of TRAC PAC, will be covered.

1. INTRODUCTION

The Transportation and Civil Engineering (TRAC) Program is the hands-on education program of the American Association of State Highway and Transportation Officials (AASHTO). TRAC is made available to secondary schools (high schools and Junior high schools) through regional centers where the Departments of Transportation (DOTs) work in partnership with other government organizations, universities, non-profit organizations, and private industry. At its most basic level, TRAC is a program designed for integration into science, math, and social studies classes. The program began in 1993 and currently has a membership of 25 States in the US. TRAC is licensed to the University of Stellenbosch, Department of Civil Engineering for use in the country of South Africa and is also licensed to the University of Dar es Salaam, Department of Civil Engineering for use in the country of Tanzania.

In actual practice, TRAC sends volunteer Transportation professionals into secondary

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schools with a TRAC PAC. The TRAC PAC consists of a computer, electronic data collection and analysis instruments, hands-on modeling materials, and more than 55 activities based on real-world transportation problems. The volunteer comes to the classroom to help the students understand how what they are learning in the school can be used to solve real world transportation problems. The volunteer's second purpose is to act as a mentor and role model to the students.

By engaging students in solving real-world problems, TRAC connects students to the work world of transportation.

2. THE TRAC PAC

The TRAC PAC contains the following software and hardware:

Vernier Motion Detector - Uses sound waves to determine the distance between itself and an object and sends this information to the TRAC computer. Multiple readings over a specific period of time give the computer the information it needs to determine the velocity and acceleration of object being measured. The motion detector is used in conjunction with the program's motion activities.

Vernier Dual Range Force Probe - Measure the amount of force applied to itself and sends that measurement to the TRAC computer. The probe is used in conjunction with the program's motion activities.
Vernier Sound Probe -Turns sound waves into electrical impulses that
Can be measured by the TRAC computer. It is used with the sound activities.

Sound Level Meter - Measures the loudness of sound in decibels. It is used with the program's sound activities.

Introduction to Engineering Videotape - Introduces students to the profession of engineering by giving a broad definition of engineering and presenting different types of engineering.

ITS Video - Presents a basic overview of intelligent Transportation Systems (ITS) and reviews the ITS experiments found in the TRAC PAC.

TRAC Model Car - Acts as a target for the motion detector and the dual range force probe during specific motion activities.

Pre-Engineering Software's Bridge Builder Software and Manual - Introduces the concepts of truss bridge design by allowing TRAC students to construct bridges on the computer.

TRAC Guide Book - Instructs students how to correctly perform TRAC activities found in TRAC PAC. The guidebook also offers a set of instructions and helpful hints for

teachers and/or visiting transportation to assist them in successfully helping students through TRAC activities.

TRAC Software CD-ROM - Serves as the master copy of all software used on the TRAC computer.

Twenty-five feet of Magnetic Tape - Creates the magnetic field under the MagLev car.

Foam Blocks - Serves as the raw material in designing and constructing the MagLev car.

Four Sections of Magnetic Track - Levitates the MagLev car during MagLev activities.

One Non Magnetic TRAC - Serves as the course for the TRAC Toy Car Motion Activity.

Five U-Supports - Elevates the five sections of TRAC when needed.

Microsoft Works or Appleworks Office Suite Software Package - The spreadsheet functions are used in several of the math modeling activities.

Vernier LABPRO Interface Box - Serves as the interface between the probes and the TRAC computer.

Vernier LoggerPro Data Collection Software Package - Used to collect and display the data collected using the LABPRO Interface Box and the Data collection probes.

3. HISTORY AND EVOLUTION OF THE TRAC PROGRAM

The purpose of the TRAC program is to raise the awareness of civil engineering and transportation careers among school students. To do this, TRAC was originally designed to be a traveling road show. A civil engineer and civil engineering student would go to a school with the TRAC PAC and computer. The TRAC team would spend the day at the school talking to as many students as possible about the field of civil engineering. At the end of the day, the team would leave the TRAC PAC and computer at the school. The school could keep the TRAC Equipment for up to 2 weeks. At the end of 2 weeks, the TRAC equipment was returned to the State DOT where it is cleaned up and the consumables replaced. Then another TRAC Team would go to a new school and the cycle began again.

Soon, schools started asking for return visits and eventually, they asked to have the TRAC equipment placed for longer periods of time. Schools also requested the TRAC team to visit more than once. TRAC management decided to take a different approach. The TRAC PAC and computer would be assigned to a school on a permanent loan basis. A TRAC Team would adopt a school and would visit classes in their adopted school at least 6 times during the school year. If a civil engineering student were unavailable, the engineer would visit the school alone or with another engineer.

Currently, TRAC schools are assigned 1 transportation volunteer. Civil Engineering students are no longer required.

The TRAC PAC and TRAC computer have evolved. The original TRAC computer was a Macintosh Classic II. This computer was chosen for its portability. Once it was decided to place the TRAC equipment permanently in the schools, IBM compatible computers using the DOS operating system where placed into the schools. IBM DOS computer where chosen for their lower cost and greater range of software. By 1995, the DOS operating system was becoming obsolete. In addition, many students using the TRAC Computer had never been exposed to the DOS environment. The only computers they were exposed to had Microsoft Windows or Macintosh operating systems. In 1996, the TRAC computers were upgraded to Pentium class computers running the Windows 95 operating system. Most of the software was upgraded to Windows compatible software.

In 1998, computers in the classroom where becoming more common. It was at this point teachers began to point out that one TRAC PAC and computer for a class of students was getting difficult to use. In 1999, TRAC began to explore ways to deal with this issue. The Texas Instrument Graphing Calculators showed promise.

These calculators, together with an external interface, can be used to analyze and display data collected with the data probes already used in the TRAC PAC. The calculator is inexpensive when compared to the cost of a complete computer system and many schools already require students to purchase them.

As the TI Graphing calculators became more popular, several more interfaces became available. In 2000, Vernier Software, longtime supplier of the data collection equipment used in the TRAC PAC, released its LABPRO interface. This new interface can be used with the TI calculators as well as Windows or Macintosh desktop and laptop computer systems. The current TRAC PAC includes the LABPRO interface and the guidebooks have activities for all three computing platforms.

4. CURRENT STATUS OF THE TRAC PROGRAM

Currently, TRAC is in a redevelopment and upgrade phase. After talking with many of the teachers who have used TRAC over the years, it was determined that the TRAC curriculum had great potential that was going unrealized because the materials where difficult for the classroom teacher to use. AASHTO compiled a list of several improvements that needed to be done to make the TRAC curriculum easier for the classroom teacher to implement in the classroom.

The current TRAC activities were rewritten in a format that is more teachers friendly. The activities are laid out in the Lab Style format that teachers typically use. Introduction, objective and materials needed sections were added to every activity. The Standard of Learning that each activity addresses is clearly stated at the beginning of

every activity. The procedures section was cleaned up and missing steps were added. In general, the activities were rewritten to make the activities self guided.

A Teacher's Notes addendum was added to the manual. This addendum provides the teacher and volunteers with addition information needed to coach students through the TRAC activities. While no answers are given in the instructor's notes, hints and tips are given.

Two of the software packages used for TRAC are DOS based. We are in the process of having these packages written for both the Windows and Macintosh operating systems.

Upgrade packages have been developed to bring the previous versions of TRAC PACs up to current standards. These packages include the new LABPRO interface, new data collection software and adapter cables for the older versions of the data probes. Additional packages have been developed that use the TI Graphing Calculators and the Macintosh Computer for data collection and analysis.

The goal of developing these upgrade packages is to eliminate the need to provide TRAC computers to schools. By incorporating Windows, Macintosh and TI platforms, the TRAC PAC can utilize any computing platform a school uses. By eliminating the cost of the computer, 2 TRAC programs can be placed in a school for the price of one.

An emphasis is being placed on the non-engineering careers of the Transportation field. While there is still a shortage of engineers going into transportation, there is an even bigger shortage of technicians, equipment operators, cad operators, information technology specialists, etc. TRAC has started to develop activities that emphasize the technical trades in transportation. Currently, we have a section on surveying and section on cad.

TRAC does have website, www.trac.net. This website contains an overview of the TRAC program and discussion lists for the TRAC Oversight Committee, TRAC Regional Center Directors, TRAC Teachers, TRAC Volunteers and TRAC Students. It is hoped that these discussion lists will foster communications between participants at all levels of TRAC. TRAC Headquarters staff will monitor all discussion lists.

5. FUTURE PLANS FOR THE TRAC PROGRAM

The current TRAC PAC has been in its present form since 1993. While there have been several upgrades made, the program overall is starting to show its age.

In 1999, The Transportation Research Board Awarded AASHTO a $350,000 grant to develop TRAC PAC 2. TRAC PAC 2 will take the best of the current TRAC PAC and add to it. TRAC PAC 2 will actually be a series of separate modules that schools can ask to receive. The current TRAC PAC is limited in the number of students it can touch. It must be "shared" by several teachers within a single school. By breaking the TRAC PAC

up into individual kits, schools can request just the modules that are needed by the school. Teachers will no longer need to coordinate usage of the PAC with each other.

New modules are being developed that will allow students to experience engineering problems in construction, geometric highway design, cad applications and environmental engineering. Problems will also include information technologies.

TRAC PAC 2 will be applicable to middle school through high school. Most of the activities will have a low tech and a high tech version. The vendor developing the new version of the TRAC PAC has been instructed to design the activities so a class of 30 students can perform the TRAC activities at the same time. In other words, each TRAC activity will include all members of a class.

Development of TRAC PAC 2 scheduled to be completed in may 2002. Production TRAC PACs should be ready to ship 2 to 4 months later.

An international TRAC competition will be designed and distributed for the 2001 – 2002 school year. This competition will consist of 10 real word transportation-engineering problems. State and regional competitions will be held within the US. One team of students from each region, along with any non US entries will be invited to compete at a world final competition at the AASHTO Annual Meeting in 2002. AASHTO members will judge entries at the national competition. The judging panel will likely consist of Chief Executive Officers and Chief Engineers of various State Departments of Transportation. The AASHTO Executive Director will pick the judging panel.

Exposing students to engineering and transportation in high school is almost too late. To that end, AASHTO will develop a version of TRAC that can be used in grades K through 4. Grades 5 through 12 will be addressed with TRAC PAC 2.

The form of the TRAC PAC K through 4 has not been finalized. We will be investigating the development of workbooks, videotapes and off the shelve computer software adapted to our needs. This approach has been used by other organizations with some degree of success.

AASHTO TRAC will investigate grants and scholarships available to students who want to continue on to college and study transportation. The goal of this investigation is to establish a TRAC Scholarship Fund. This fund would be available to students who have used the TRAC program and shown a strong interest in transportation. Selection of recipients will be made by AASHTO.

As stated previously, the shortage of transportation professionals is not limited to engineers. There is a large shortage of technicians, cad technicians, equipment operator, etc. To address this problem, TRAC will be looking into developing curriculum for Community Colleges that will teach the specific cad and technician skills needed for the transportation industry. This approach has been successfully used by other industries to get a large pool of skilled workers in a short amount of time.

6. SUMMARY

The AASHTO TRAC program is a hands on educational program. Its purpose is to expose as many students as possible to careers in Transportation Industry. It does this by giving the students activities that show them how what they learn in school is used in the real world of transportation. A visiting transportation professional works with students in the classroom.

TRAC's original focus was on civil engineers. That focus has been widened to all transportation careers.

The TRAC PAC is undergoing several updates that are designed to make it easier for the teacher to apply in the classroom.

AASHTO is looking at expanding TRAC in to the earlier grade levels and into community colleges.